TABLE 2.—*Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during April, 1929*

Altitude m. s. l.	Broken Arrow, Okla. (233 meters)		Burlington, Vt. (132 meters)		Cheyenne, Wyo. (1,868 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Havre, Mont. (762 meters)		Jacksonville, Fla. (65 meters)		Key West, Fla. (11 meters)		Los Angeles, Calif. (40 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Meters	°		°		°		°		°		°		°		°		°		°	
Surface	S 6 E	1.7	S 57 W	1.4	N 67 W	2.7	S 58 W	0.9	N 23 W	1.4	S 18 E	1.7	N 84 W	0.5	S 42 W	1.3	S 47 E	2.2	N 62 E	1.6
500	S 18 W	5.6	S 49 W	3.2	----------	----	S 67 W	5.1	N 19 W	1.3	S 13 E	4.9	----------	----	S 40 W	3.1	S 50 E	5.0	S 27 E	1.3
1,000	S 40 W	9.1	S 74 W	3.6	----------	----	S 85 W	7.3	N 74 W	1.8	S 6 W	3.0	S 61 W	2.9	S 45 W	3.5	S 50 E	3.2	N 64 W	0.5
1,500	S 78 W	9.3	N 74 W	5.9	----------	----	W	6.2	N 80 W	3.4	N 42 W	4.0	S 85 W	4.7	N 86 W	2.8	S 29 E	1.5	N 19 W	2.0
2,000	S 87 W	10.3	N 74 W	10.0	N 76 W	5.7	N 79 W	7.7	N 71 W	5.1	N 75 W	1.8	S 88 W	5.1	N 82 W	3.7	S 12 W	1.4	N 40 W	3.4
2,500	S 85 W	11.0	N 50 W	12.7	N 85 W	10.8	N 79 W	8.9	N 74 W	6.9	S 83 W	4.7	S 89 W	6.1	N 87 W	5.6	S 52 W	1.6	N 48 W	5.6
3,000	N 87 W	10.3	N 48 W	14.5	N 80 W	13.0	N 77 W	8.3	N 66 W	6.7	----------	----	S 88 W	6.1	S 85 W	4.3	N 76 W	1.7	N 58 W	7.7
4,000	N 83 W	12.7	N 48 W	13.6	N 69 W	12.1	N 75 W	11.3	N 60 W	8.5	----------	----	N 70 W	9.7	N 77 W	6.7	N 58 W	4.0	N 68 W	9.8
5,000	----------	----	----------	----	N 73 W	9.4	N 85 W	9.2	N 67 W	11.9	----------	----	N 83 W	9.8	N 74 W	7.9	N 60 W	6.9	----------	----

Altitude m. s. l.	Medford, Oreg. (446 meters)		Memphis Tenn. (145 meters)		New Orleans, La. (25 meters)		Omaha, Nebr. (313 meters)		Royal Center, Ind. (225 meters)		Salt Lake City, Utah (1,280 meters)		San Francisco, Calif. (60 meters)		Sault Ste. Marie, Mich. (198 meters)		Seattle, Wash. (67 meters)		Washington, D. C. (34 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Meters	°		°		°		°		°		°		°		°		°		°	
Surface	S 65 E	0.3	S 8 E	2.6	S 73 E	0.7	N 3 W	0.3	S 34 W	1.2	S 44 E	1.1	N 89 W	1.1	N 9 E	1.2	S 40 E	2.6	N 54 W	0.9
500	S 68 W	0.2	S 33 W	6.5	S 17 E	5.8	S 20 W	1.2	S 57 W	3.8	----------	----	N 78 W	3.2	N 40 E	1.6	S 22 W	2.8	N 76 W	5.4
1,000	S 76 W	1.6	S 64 W	7.8	S 21 W	5.4	S 34 W	3.4	N 84 W	5.7	----------	----	N 68 W	4.9	N 20 W	1.9	S 57 W	3.9	N 75 W	10.0
1,500	S 40 W	2.2	S 88 W	7.8	S 25 W	4.3	S 76 W	3.4	N 74 W	6.0	S 29 E	2.4	N 61 W	3.4	N 37 W	3.3	S 74 W	2.1	N 77 W	10.6
2,000	S 57 W	4.1	S 87 W	6.2	S 65 W	3.6	N 74 W	5.8	N 74 W	8.4	S 65 W	1.8	N 56 W	3.1	N 12 E	5.3	N 64 W	4.2	N 69 W	11.1
2,500	S 72 W	4.2	N 72 W	8.2	N 85 W	3.7	N 72 W	7.7	N 72 W	9.4	N 81 W	3.0	N 67 W	5.8	N 19 E	3.6	N 60 W	4.0	N 66 W	10.6
3,000	S 75 W	5.1	N 64 W	10.0	N 89 W	5.4	N 74 W	10.2	N 65 W	11.6	N 76 W	6.2	N 65 W	7.0	N 10 W	6.2	N 61 W	4.1	N 79 W	10.4
4,000	----------	----	----------	----	S 86 W	6.8	N 80 W	14.9	----------	----	N 80 W	8.0	S 89 W	7.5	----------	----	----------	----	----------	----
5,000	----------	----	----------	----	N 70 W	9.0	----------	----	----------	----	----------	----	----------	----	----------	----	----------	----	----------	----

551.506 (73)

WEATHER IN THE UNITED STATES

THE WEATHER ELEMENTS

By P. C. DAY

GENERAL CONDITIONS

April, 1929, like the preceding month, continued moderately warm over most districts from the Rocky Mountains eastward and also like March it continued cool to the westward. The precipitation was generally greater than normal, except over portions of the Southwest and near-by areas in the west Gulf section and locally in some other small areas, aggregating about one-fourth of the country with precipitation less than normal.

PRESSURE AND WINDS

The month opened with a well-defined cyclonic storm central over lower Michigan, attended by heavy snows or rains and snows over portions of the Lake region and upper Mississippi Valley and by precipitation generally from the middle and northern Plains eastward to the Appalachian Mountains, continuing during the following day into the more northeastern States. Generally fair weather prevailed thereafter until the 4th, when rain set in over the Pacific Coast States, extending during the 5th into most districts to westward of the Rocky Mountains and changing to snow in some of the elevated districts. At the same time conditions favoring local thunderstorms overspread the region from the Ohio Valley and eastern Lake region to the middle Atlantic coast, continuing over some of this area during the following day and extending westward into the upper Mississippi Valley and portions of the Northwest, the western precipitation area having largely broken up on reaching the Great Plains.

At the a. m. observation of April 8, thunderstorm conditions existed over a narrow area from the lower Rio Grande Valley northeastward to the Great Lakes, attended by local heavy rains in portions of Missouri and Texas, and during the following 24 hours the rain area extended slightly eastward, the heavy falls occurring mostly in eastern Texas and portions of the lower Mississippi Valley. During this period low barometric pressure was developing in the far Southwest and by the morning of the 10th it had extended to the southern Plains, while the area favorable to thunderstorms had advanced to North Carolina, and at 8 a. m. of the 10th precipitation had overspread a wide area from the northern and central mountains southeastward nearly or quite to the middle and south Atlantic coasts, considerable snow occurring over the mountain States with more or less heavy rains in the Ohio Valley. The eastern precipitation area practically disappeared by the 11th, but the center of the Plains area had moved northeastward to the upper Mississippi Valley and local rains continued over wide areas in the central valleys and toward the Atlantic coast.

During the following 24 hours, local rains continued in the Lake region and generally from the middle Gulf eastward to the Atlantic coast and thence northward to southern New England, the storm disappearing during the following day to northward of the Great Lakes with some snow occurring in the northern portions of New York and New England.

About the 14th and 15th precipitation overspread considerable portions of the far Northwest and at the same time cyclonic conditions developed in the Southwest, which, by the morning of the 15th, had reached the Middle Gulf States and heavy rains had occurred locally in the area affected. This storm moved to the immediate middle Atlantic coast by the 16th and heavy rains had extended into portions of this area, the precipitation area passing off the New England coast attended by local snows in the elevated regions of the Northeastern States.

After a considerable period without important precipitation over the Pacific coast, about the 19th and during

the following few days more or less precipitation occurred over the region extending eastward into the Middle Plateau and Rocky Mountain section, and by the morning of the 20th the rain area had reached the central valleys with local heavy falls in portions of the upper Mississippi Valley and near-by areas. During the following day this rain area passed off the north Atlantic coast with diminishing intensity.

By the 24th a cyclone of considerable strength had entered over the middle Plains, moving thence to the southern end of Lake Michigan by the 25th, with very general rains over the central valleys and to near the Atlantic, passing, during the following day, to northen New England with general, but moderate precipitation.

During the 28th and 29th considerable rainfall overspread the eastern one-third of the country and on the 30th some rain fell over the northern districts from Washington eastward to the Great Lakes and over the northern portions of New York and New England.

The most important anticyclone of the month had overspread the southern Plains by the morning of the 1st, attended by changes to colder of 20° to 30° over a considerable area in the Southwest. As this anticyclone moved eastward it was attended by some of the coldest weather of the month, particularly from the Great Plains eastward to the Mississippi Valley and northeastward to New England. The next important anticylcone moved into the Dakotas on the morning of the 8th and passed eastward over the more northern districts, but without important temperature changes. The latter part of the month had much cool weather, but the changes from day to day were mainly unimportant, though during the last decade some of the lowest temperatures of the month occurred.

The average sea-level pressures were less than normal in practically all parts of the country, and the changes from the preceding month were negative save along the extreme northern border and over the adjacent portions of Canada.

Storms of the thunderstorm type became more numerous, as is usually the case with the approach to summer, and a number of these took on the tornado type and caused material property damage and the loss of nearly 200 lives, these occurring mainly in Georgia, Arkansas, and Wisconsin. The details of these storms appear in the table at the end of this section.

TEMPERATURE

The month opened with decidedly cold weather advancing eastward over the Great Plains, the cold area reaching the Atlantic coast districts by the morning of the 2d, after which there was a quick rise to the general warmth that had prevailed during much of the latter part of March over these districts.

The first week as a whole averaged well above the normal in all these districts, the averages being especially high from the middle Plains eastward, where they ranged from 10° to 20° or more above the normal. West of the Rocky Mountains this period was distinctly cool, the averages ranging largely from 6° to 12° below the normal.

The week ending the 16th began with cooler weather existing in nearly all central and western districts, but high temperatures still persisted in the East and Southeast until about the 11th when cooler weather set in over those districts, and moderate coolness persisted in many districts until the end of that week, the averages for the period being below normal over all sections save from Texas eastward over the Gulf and South Atlantic States where they ranged up to as much as 6° above the normal.

During the week ended April 23 there were no important temperature changes, the averages being moderately lower than normal from the middle Plains eastward, while they continued slightly warmer than normal in the west Gulf area and was also moderately warmer than normal over the Plateau and Rocky Mountain areas, and slightly cooler than normal over most of the Pacific coast area.

The last week of the month showed no radical departures of temperature from the normal, the week being moderately cool in most districts, though the weekly means continued above normal in most of the Gulf States and over the Great Plains area.

The month, as a whole, was warmer than normal from the Great Plains eastward, save for a small area in New England, and cooler in the Rocky Mountain area and to the westward, while the eastern Provinces of Canada were generally warmer and the western Provinces cooler than normal.

The monthly means of temperature at Corpus Christi, and Galveston, Tex., and Norfolk, Va., were the highest of record for April, while in portions of Oregon they were among the lowest ever observed.

Many stations in the central and eastern parts of the country had unusually high temperatures during the first decade, particularly about the 6th to 8th, when, at some points, they were the highest of record so early in the season. At New Orleans, La., the maximum temperature on the 25th, 90°, was the highest of record in April.

The periods of lowest temperatures were mainly on the 1st and 2d over the northeast, middle Plains, upper Mississippi Valley, and along the northern border to the eastward; about the 10th to 12th in the Mountain and Pacific Coast States; and the 16th to 18th in the Gulf and South Atlantic States and Ohio Valley.

A minimum temperature of 37.8° on the morning of April 8, at Yuma, Ariz., was the lowest ever observed in April at that place in more than 60 years.

PRECIPITATION

The distribution of the monthly precipitation is graphically shown on Chart V, and the departures from normal values are shown on the small inset to that chart.

Generally speaking, precipitation was in excess of the normal over middle and northern portions and slightly deficient in most southern sections. The excesses were large from the Great Lakes eastward and over most of Missouri and portions of near-by States, the total falls being the greatest of record for April at numerous points in the Northeastern States. In portions of northwestern Texas the precipitation was the least of record for April, while at a few points in the eastern part of that State heavy thunderstorms on the 13th broke all previous records of excessive precipitation for short periods of time.

SNOWFALL

Snowfall occurred in varying amounts ranging from 73 inches in some of the high mountains of the far Northwest to the usual traces in the central parts of the country.

At a few places the amounts were unusually heavy, notably in northern New England on the 12th and 13th, when 17 inches fell at Northfield, and in Wyoming, where, in the vicinity of Cheyenne, 11 inches of wet, heavy snow fell on the 23d and 24th, causing much delay in transportation and damage to overhead wires, and similar falls occurred in other parts of the State about the same time,

likewise tying up transportation and causing immense damage to wire systems.

Heavy snow, sleet, and glaze occurred in portions of Wisconsin and Michigan from the storm of March 31–April 1, causing much damage to overhead wires, shade, fruit, and other trees.

At a few points, notably in Nevada, the snow was the heaviest of record for April, while at Red Bluff, Calif., snow on the 5th was the first ever observed in April.

RELATIVE HUMIDITY

As a rule, the percentages of relative humidity were above the average at most points to east of the Rocky Mountains, while to the westward they were mostly less, save along the immediate Pacific coast where they were again above the average.

Large negative departures are noted at points in New Mexico and some near-by areas and in eastern Washington, and local areas in southern Idaho and northern Utah had equally large positive departures. As a rule, however, the departures from normal were comparatively small.

551.515(08)(73)

SEVERE LOCAL STORMS, APRIL, 1929

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau]

Place	Date	Time	Width of path, yards [1]	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Kentucky (western)	1				$25,000	Wind	Buildings destroyed or damaged; wire lines injured.	Official, U. S. Weather Bureau.
Louisville, Ky	1	A. M.			10,000	do	2 oil barges sunk; windows and buildings damaged.	Do.
Hardin County, Ohio	1	do				Wind and hail	Considerable losses; greenhouses suffered severely.	Do.
New York (mainly western, central, and northern).	1			1	400,000	Wind	Hangar and small buildings wrecked; houses unroofed; trees and wire lines blown down; docks and boathouses damaged.	Official, U. S. Weather Bureau. Courier Express (Buffalo, N. Y.).
Portland, Pa., to Blairstown, N. J.	1	4–5 p. m.	100	3	50,000	Tornado	30 buildings destroyed; several persons hurt. Path 8 miles long.	Official, U. S. Weather Bureau.
Ottawa to Rogers Counties, Okla.	3	12:15–12:45 p. m.	1,760		4,200	Severe hail	Greatest damage at Vinita. Path 35 miles long.	Do.
Lyon County, Iowa	5	3 p. m.		1	21,000	Tornado	Some hail with tornado	Do.
Hennepin County, Minn., to Polk County, Wis.	5	5:30 p. m.	200–440	6	1,000,000	do	Traversed part of Minneapolis. Path 70 miles long.	Do.
Pierce to Iron Counties, Wis.	5	5:45–8:30 p. m.	30–400	12	725,000	Tornado and hail	Losses chiefly farm buildings, livestock, wire lines. Path 170 miles long.	Do. Journal (River Falls, Wis.); News (Ladysmith, Wis.).
Hancock County, Iowa	5	6:30 p. m.			10,000	Tornado	4 persons hurt	Official, U. S. Weather Bureau.
Cloud and Washington Counties, Kans.	6	2:30–3:30 p. m.	200–880		40,000	do	Farm buildings and wire lines damaged. Path 45 miles long.	Do.
Cloud to Marshall Counties, Kans.	6	2:30–4:10 p. m.	1–5 mi.		60,000	Wind and hail	Embraced the tornado-swept area noted above.	Do.
Mitchell County, Kans	6	3 p. m.	880		2,000	Heavy hail	Roofs and glass damaged. Path short	Do.
Iowa (east-central)	6	4–7 p. m.			5,800	Hail and wind	3 countries affected	Do.
Grant, Lafayette, and Green Counties, Wis.	6	4:30–6:20 p. m.	30–440		250,000	Tornado and hail	Losses chiefly in buildings, wire lines, livestock, and timber. Many injured. Path 50 miles long.	Do.
Union County, Iowa	6	7 p. m.			4,000	Tornado	No details reported	Do.
Warren County, Iowa	6	7:30 p. m.	30		3,400	do	8 persons hurt. Path 4 miles long	Do.
Jasper and Marshall Counties, Iowa.	6	do			25,000	do	1 person injured. Path 25 miles long	Do.
Perry, Okla., and vicinity	7	1–1:30 p.m.	3 mi.		22,000	Heavy hail	Damage chiefly to crops. Path 10 miles long	Do.
Chicago, Ill	7	7:45 p. m.			3,000	Small tornado	Path in south part; short and very narrow	Official, U. S. Weather Bureau.
McDonald County, Mo	7	9 p. m.			600	*Probably tornado*	*Some buildings damaged; no person harmed.* Path narrow and 3 miles long.	Do.
Scurry, Tex	8	2 a. m.	800		3,500	Tornado	Buildings damaged	Do.
Ennis, Tex	8	3 a. m.	300			do	Destroyed small buildings; 1 person injured	Do.
Clarksville, Tex	8	5 a. m.	30			do	Small buildings damaged	Do.
Humble, Tex	8	11 p. m.			20,000	Wind	Oil derricks blown down	Chronicle (Houston, Tex.).
Lake Charles, La	9	2:30 a. m.			25,000	do	Oil equipment damaged	Official, U. S. Weather Bureau.
Clark County, Kans	9	4 p. m.				Small tornado	Touched ground but once	Do.
Kansas (northwest part)	9	4:30–7 p. m.				Heavy hail	Damage small, chiefly to fruit; 3 counties affected.	Do.
Chautauqua County, Kans	9	8:30 p. m.			1,500	Small tornado	Path 15 miles long	Do.
Latham, Kans	9	11 p. m.	50		3,000	do	Path but half mile long	Do.
Neosho County, Kans	9–10	11 p. m.–2 a. m.			2,500	Heavy hail and small tornado.	Windows broken and automobile tops punctured by hail.	Do.
Calico Rock, Ark. (near)	10	3 p. m.	220			Tornado	Damage slight. Path 1 mile long	Do.
Troup, Tex	10	3:18 p. m.	2 mi.		23,500	Hail	Buildings and crops damaged. Path 11 miles long.	Do.
Almond to Moorefield, Ark	10	4–4:20 p.m.	170		20,000	Tornado	Several injured. Path 14 miles long	Do.
Almond to Lorado, Ark	10	4–7:45 p.m.	200–1,200	31	308,000	do	*Started near preceding; worst havoc near Swifton.* Path 65 miles long.	Do.
Mount Pleasant, Ark	10	4:30 p. m.				do	Damage slight. Path narrow and short	Do.
Herpel to Mount Pleasant, Ark.	10	5 p. m.	300–400	7	216,000	do	Guion almost obliterated. Path 18 miles long	Do.
Alice, Tex	10	do	15			Small tornado	Destroyed poultry house	Do.
Diaz, Ark	10	6:20 p. m.	300		11,000	Tornado	2 persons hurt. Path 2 miles long	Do.
Monette, Ark	10	8 p. m.	220		40,000	do	Path 2 miles long	Do.
Wynne (near) to Parkin, Ark.	10	8–8:30 p.m.	100	18	200,000	do	Princedale suffered most. Path 16 miles long	Do.
Wynne, Ark	10					Hail	Considerable damage	Do.
Coffey County, Kans	10	8:15 p. m.	3–4 mi.			Heavy hail	Path 5 miles long	Do.
New Jersey coast	10–11				150,000	Gale	Surf high; houses swept away; boardwalk partly torn out. Northern Ocean County suffered most.	Do.
Ellis County, Okla	13	5 p. m.	5 mi.			Heavy hail	Damage considerable	Do.
Canadian County, Okla.	13	10–11 p. m.				do	Gardens and fruit trees suffered	Do.
Smithville, Tex	14	6:10 a. m.	400		75,000	Tornado	Several injured; buildings damaged	Do.

[1] "Mi" signifies miles instead of yards.